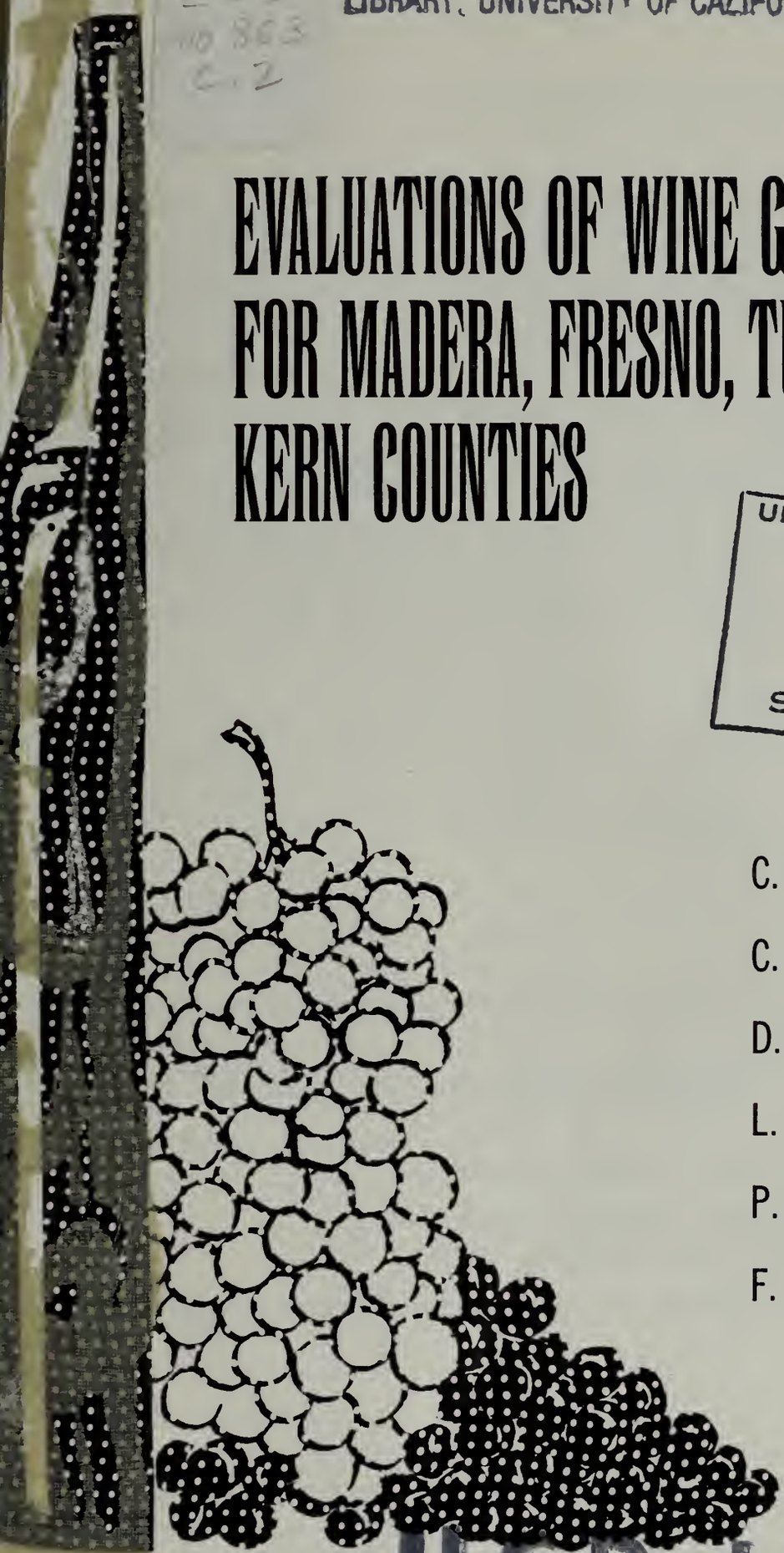
Division of Agricultural Sciences
UNIVERSITY OF CALIFORNIA

EVALUATIONS OF WINE GRAPE VARIETIES FOR MADERA, FRESNO, TULARE, AND KERN COUNTIES



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Data on grape must and wine composition and quality in Madera, Fresno, Tulare, and Kern counties were gathered for the period 1934–1972. The data summaries presented in this publication cover only samples gathered from those counties, but consultations with wine makers from all parts of California were undertaken and consensuses of opinions expressed were strongly considered during the authors' evaluations. Special experiments in high-salt areas of grape production are also reported herein, and viticultural characteristics for many varieties are given; characteristics include production, harvest time, vigor, and harvestability by hand and machine. The wine varieties studied are grouped into three categories: good, questionable, and poor.

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Evaluations of Wine Grape Varieties for Madera, Fresno, Tulare, and Kern Counties[1]

INTRODUCTION

THE PURPOSE OF VARIETY evaluation studies is to determine which varieties are best suited for particular areas from viticultural and enological viewpoints. In the past, some studies have been criticized for using grapes grown in areas far from other similar climate- and soil-type areas to evaluate the latter areas as to their potential for growing the varieties studied. Such criticisms are sometimes valid, but in general the recommendations made in these reports have been sound. In our study, the area encompassed by the evaluations is quite large (Madera, Fresno, Tulare, and Kern counties) but the climates are similar and what differences there are in soil, or in irrigation or cultivation techniques, have been taken into account.

The evaluations given herein are based not only on experimental data but also on data gathered from contacts with the wine-making industry by the authors, who met with almost all of the major producers in the area studied. Available University varietal experimental data were given to the winemakers, and industrial and other problems were discussed. As a result, consensus opinions of these professionals played a substantial part in the evaluations presented in this report. It was gratifying that the winemakers not only agreed among themselves to a large extent, but also that their opinions largely supported past University varietal recommendations. Growers should also consult their own local wineries as to which grape varieties might be preferred in future years. Good reasons for not growing a particular variety in an area are pointed out; growers should be aware of these facts, as ignoring them might result in negative reconsiderations by purchasing wineries at some future time. Additionally, the local Farm Advisor may be of great help in deciding upon suitable varieties.

Amerine and Winkler (1944, 1963) have given variety recommendations for all of California's grape areas, and evaluations for the warm areas are discussed in some detail by Alley *et al.* (1971).

METHODS AND MATERIALS

Selecting and transporting grapes

Grapes harvested from the Kearney Horticultural Field Station were partially from certified stock and partially from standard material available at the time. The certified material was grown on its own roots and the other material was on a variety of rootstocks. Material from the West Side Station was also on various stocks and was not certified. The type of stock appeared to have little or no effect on the wine quality of grapes from these irrigated vine-

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yards. (This factor will be discussed in a later report.) Standard vineyard care and normal irrigation practices were maintained, and pruning and training practices were normal.

Grapes from Kearney, the West Side Field Station, or from Farm Advisor plots at Bakersfield were usually picked the day they were to be hauled to Davis. All grapes were hand picked and transported in 50-pound field lugs. Truck time from Fresno to Davis is about 4 to 5 hours, and the fruit arrived in excellent condition with no noticeable juicing. The boxes were held outside during the night and crushed the next day. The grapes were cool (60–70°F) when crushed. On rare occasions the grapes were picked the day prior to transport.

Winemaking

Grapes were crushed and stemmed with a Garolla-type crusher stemmer. The white grape must was put directly into a basket press and the juice separated from skins and pulp. This is equivalent to free-run juice, as understood commercially—total non-soluble solids are very low in such juice. Red grape varieties were crushed directly into the vat for initial fermentation, and representative juice samples were then taken for must analysis. Seventy-five mg per liter of sulfur dioxide was added to both the red must and white juice. After ½ to 1 hour, about 1 per cent by volume of a good, pure culture of *Saccharomyces cerevisiae* strain Montrachet was added to the must. The white wines were fermented at 70°F except in 1970 when they were fermented at 60°F. The red wines were all fermented at 70°F.

The red wines were mixed thoroughly twice a day while in contact with the skins. At the end of 3 days, the red wines were pressed. The Brix reading at this time was usually between 5° and 10°. The fermenting must was allowed to finish at 70°F. Total time of fermentation was usually 5 to 10 days. Daily Brix readings were taken on white and red wines during the fermentation period. Dessert wines were fortified, usually between 14 to 16°Brix, allowed to settle for about 12 hours, and then racked and cellared. Dry wines were racked into full containers and, when dry, were removed to the cellars and held at 53 to 55°F for 2 weeks, after which they were racked. They were racked again in 1 month and again 1 month later. After addition of 25 mg per liter of sulfur dioxide the wines were filtered and bottled.

All the wines were tasted in November and decisions made as to further treatment. If hydrogen sulfide was detectable, the wines were aerated and 50 mg per liter of sulfur dioxide added and filtered after 10 days. In most cases, this treatment removed the hydrogen sulfide. If a red wine was particularly low in acid, an additional 75 mg per liter of sulfur dioxide was added to prevent malolactic activity until at least after the panel tasting. No aging in wood was attempted except with dessert wines, which were almost without exception stored in small American oak cooperage (5 to 15 gallons) from 6 months to 2 years. No special treatments were given to any of the wines—on the contrary, treatments were as alike as possible.

Wine evaluation

Analyses were made on the must and on the wine, as suggested in Amerine (1965). All wine samples for analyses were cold stabilized at 32°C for 2 weeks or longer to assure that acid and color values were those of stabilized wines. None of the wines were bentonited or cold stabilized for sensory purposes. Sensory evaluations

were done as outlined in Ough and Baker (1961). The panel included staff members with wine sensory evaluations experience of 15 to 30 years. The wines were tasted early in the spring following the year they were made. For the most part no malo-lactic fermentations had taken place. Later tastings were made over the years, mainly by the senior author. In general, these tastings reinforced the panel results. Such points as the effect of malo-lactic fermentation, color loss, etc. on wine quality were noted.

RESULTS AND DISCUSSION

Tables 1 through 4 summarize must and wine analytical and sensory data for the four counties gathered by the Department of Viticulture and Enology since 1934. Table 5 gives viticultural information concerning these varieties and comments on their tolerances to mildew, bunch rot, etc. (Tables start on page 10.) For more detailed description of the varieties, general training, and pruning practices see Kasimatis *et al.* (1972).

Growing wine varieties under high salt and boron condition was studied at the West Side Field Station. The production of many of the varieties were below accepted industry ranges (table 6). French Colombard did exceptionally well under the adverse conditions of the station.

Grapes should be harvested at optimum maturity (this can vary depending on variety and conditions); this is generally the concern of the purchasing winery and is determined by experience with individual varieties from various areas. Grapes should arrive at the winery in good condition. White varieties should be separated from their skins as rapidly as possible with a minimum of pulp, their juices sulfited and, if possbile, clarified; juices are then fermented with a good yeast at cool temperatures (45° to 60°F), in such a way that a minimum of oxygen contacts the wine (the yeast and lees are removed from contact with the wine as soon as possible). Red varieties are fermented at temperatures of 65 to 80°F (never over 85°F). Red wines should be pressed at 10° to 5° Brix (depending on the variety); storage and cellar treatment should discourage malo-lactic fermentation by: adequate and early racking, judicious use of sulfur dioxide, cool storage, early filtration, use of fumaric acid and pH adjustments, and removal of hydrogen sulfide as quickly as possible. There are special considerations such as decolorization or acidity adjustment, which are considered for individual cases, and treatments depend upon causes and circumstances.

The evaluations of these data are summarized on page 6 in tabular form. Some varieties still need additional testing, and these are so noted. Others have received good evaluations, while some are definitely of inferior quality. All varieties available have not been tested and many have never been thoroughly tested, although sufficient evidence exists to preclude most of these from further study. Certain varieties which have been badly infected with virus disease and show marked viticultural changes in growth and maturity after certification will be screened at Davis and retested if feasible.

The future possibility of new vinifera hybrids now being developed at Davis and elsewhere give promise of improved wine quality in this area.

The economics of vineyard planting and upkeep, harvesting, etc. can change rapidly. Cost information is available from your local Farm Advisor.

Evaluations for Madera, Fresno, Tulare, and Kern Counties

White Table Wine Varieties

Good

- Chenin blanc
- French Colombard
- Thompson Seedless (mainly for blending)

Questionable

- Emerald Riesling, Sémillon } (winery problems)
- Peverella, Helena, Sauvignon blanc } (further testing)

Poor

- Burger
- Flora
- Green Hungarian
- Saint-Emilion
- Sauvignon vert
- Sylvaner
- Whlte Malaga—(OK for grape concentrate or white dessert wine)
- White Riesling

Red Table Wine Varieties

Good

- Barbera
- Carignane (for standard blending material)
- Grenache (for rosé, limited)
- Petite Sirah (careful attention to pH necessary)
- Rubired (for color, blending)
- Ruby Cabernet

Questionable

- Royalty, Salvador } (inferior in crop and color to Rubired)
- St. Macaire, Gamay (Napa) } (need further testing)

Poor

- Alicante Bouschet
- Black Malvoisie
- Cabernet Sauvignon
- Calzin
- Grignolino
- Malbec
- Niabell
- Pinot noir
- Pinot St. George
- Valdepeñas
- Zinfandel

White Dessert Wine Varieties

Good

- Mission
- Muscat of Alexandria
- Muscat blanc (for sweet table wine)
- Palomino (for sherry)

Questionable

- Fernão Pirès
- Verdelho

Poor

- Malvasia bianca
- Orange Muscat

Red Dessert Wine Varieties

Good

- Carignane (for standard port)
- Rubired (blending)
- Tinta Madeira (poor production)

Questionable

- Royalty
- Souzão

Poor

- Grenache
- Muscat Hamburg
- Tinto cão
- Trousseau

A general consensus of opinion regarding the enological behavior and needs of a number of varieties has been compiled in tabular form and is presented on the following pages. The information was gathered during the course of this study from various winemakers and from testing done at Davis. Much of it consists of opinions derived from years of experience, or from purely observational data gathered under less than scientifically perfect conditions. However, these opinions and observations are for the most part in good independent agreement with those of other workers and researchers, and with findings resulting from studies made by University of California investigators.

Enological Considerations of Various Varieties

White table wine varieties	Comments
Chardonnay	Will oxidize. Early maturity may bring in elemental sulfur. Wine made from over-mature fruit has odd flavors. Ferments extremely rapidly. Does not have sufficient Chardonnay aroma from these areas.
Chenin blanc	Wines are fruity and clean. May have to adjust acid upward. Some prefer to pick early to preserve acid, and to blend or fortify later.
Emerald Riesling	Wines tend to brown badly. Can be decolorized but hurts the quality. Are good blending wines when picked at an early maturity. Browns less when harvested early. Wine pH will be very low and less SO_2 is required.
French Colombard	The wine has a larger quality tolerance to maturity, but if picked too late has a brown color and off flavors. Generally considered one of the best white varieties for the area. Settles and racks clear. May have a slight bitter flavor in young wines.
Saint-Emilion (Ugni blanc, Trebbiano)	Wines are of ordinary to poor quality. They are neutral and low character. Used in Europe for distilling material, vermouth base, and ordinary wines.
Sauvignon blanc	If picked at early maturity, it will have a slight varietal character and make a fruity wine. If picked later, tends to produce a flat, coarse wine. Matures to a high sugar.
Sauvignon vert	Gives wines of a distinctive character, slight muscat, but tends to be flat, oxidized and coarse tasting. At best medium poor.
Sémillon	Wines tend to be flat. The acidity should be adjusted as soon as possible. Quality poor if grapes are overripe or vines are overcropped. Wines have browning tendencies. The quality of the wines are borderline.
Thompson Seedless	Most resistant to browning of the white varieties. If handled properly and not from overcropped vines makes an excellent blending wine. It is successfully used for most wine types. However, if vines are overcropped or not harvested at optimum maturity will make a coarse, unpleasant wine. Its poor reputation as a table wine variety for this area is not deserved.
White Riesling	Has tendency to brown. Will have slight varietal character in some years, but at most will be just a fruity wine. Mold and rot in the grapes a factor in wine quality. Failure to make a truly varietal wine justifies the reasons for not planting this variety as does its poor production.

Red table wine varieties	Comments
Alicante Bouschet	Poor color stability, high astringency, and poor wine quality discourage the use of this variety.

Barbera	Wines have good color if from vines free of virus. Has a high acid and good balance in the wines.
Cabernet Sauvignon	Wines lack varietal character and are seriously damaged by malo-lactic fermentation. Inferior to Ruby Cabernet in all respects for this area.
Calzin	Too astringent for any useful purpose.
Carignane	Quality is only fair but it is useful for blending and as an ordinary wine. For maximum color the must is sometimes heated. This decreases quality.
Grenache	Gives a fruity rosé. If wines are made as red table they are orange in color and of poor quality. Should not be so used. Must prevent malo-lactic bacterial infections or quality is rapidly destroyed. A pH adjustment is mandatory.
Malbec	Of lesser quality than Cabernet Sauvignon. Wines rapidly undergo malo-lactic fermentation and lack quality. Color is fair.
Petite Sirah	Wines are soft and fruity. The pH is very high and should be adjusted downward as soon as possible. Color is excellent. Wine is very good for blending.
Pinot St. George	No data for the counties in question are available. However, wines from Lodi and Davis are much inferior to those from the cooler areas. If the quality trend continued, the wines from the still warmer regions would be very flat with high pH's and little character.
Royalty	This variety has good color for blending but is inferior to Rubired in all respects.
Rubired	High amount of color for blending; the best color variety. As with all color varieties a second fermentation on the pressed skins yields additional color.
Ruby Cabernet	The wine can be aged for a short time. For best results, prevent malo-lactic fermentation. Adjust acidity if needed as soon as possible. Best quality red table wine. Distinctive varietal character which can be maintained by proper cellar care.
Salvador	High color wine for blending. May use up to 20 per cent in some areas; in other areas less is tolerated because of hybrid aroma.
Tinta Maderia	Has medium color and high pH, questionable use in table wine. Other varieties of better production have more to offer.
Valdepeñas	Gives ordinary wines of low to medium color and fair quality. Not better than Carignane.
Zinfandel	Wines reflect the usual high rot and mold content of the grapes. No varietal character is present. Color is usually fair to good if not overcropped. If rot can be controlled by gibberellin treatment and proper yields obtained, further testing could be done.

White dessert wine varieties	Comments
Fernão Pirès	Easily clarified, good quality. Neutral.
Mission	Some amber color. Wines are spicy and average quality.
Muscat of Alexandria	Browns with extended skin contact. If wines ferment to near dryness they often become bitter.
Muscat blanc (Muscat Canneli)	If left on skins, wines brown. If removed from skins early, a more delicate wine of higher quality results. This and other muscat varieties' main use at present is for sweet table wines.
Orange Muscat	Wines are of lesser quality and brown easily. Lower muscat aroma.
Palomino	Preferred variety for sherry. The neutral flavor of the wine also makes it useful for other purposes.
White Malaga	Because of the late maturity of this variety, it has been used for ordinary white dessert wines and for grape juice concentrate. The wines are ordinary. If pH is too high, a very rubbery-smelling wine can result.

Red dessert wine varieties	Comments
Grenache	Makes an orange wine at best. Suited for tawny port or white port if skins and juice are separated early. At present, best use is as a rosé.
Royalty	High color for port blending. Not as good as Rubired.
Rubired	Best color and port blending variety. Color is red with very little purple. Quality of wine is excellent.
Souzão	Good color but slightly less than that of Rubired. Good quality for blending.
Tinto cão	High pH wine, poorer color and much poorer quality than Tinta Madeira.
Tinta Madeira	Good varietal flavor, high pH and medium color. Good blending wine for port.
Trousseau	High pH, off flavor, are usually due to excessive rot. Has the flavor of overripe Grey Riesling.

TABLE 1

ANALYTICAL AND SENSORY DATA FOR EVALUATION OF WHITE TABLE WINE GRAPES IN MADERA, FRESNO, TULARE, AND KERN COUNTIES.

Variety	Years tested	Number of years sampled	Number of samples	Average date of harvest	Must analysis			Wine analysis					
					°Brix	Total acid (g H_2Ta per 100 ml)	pH	Fixed acid (g H_2Ta per 100 ml)	Extract (g per 100 g)	Ethanol (per cent v per v)	Total phenols (mg per l)	Color intensity*	Average sensory score†
Baco blanc	1959–71	4	7	21 Sept.	20.3	0.88	3.48	0.72	1.9	11.4	198	L	12.1
Chardonnay	1959–71	3	30	14 Aug.	20.5	0.92	3.60	0.75	2.1	11.4	190	7.0	13.6
Emerald Riesling	1959–71	4	12	14 Sept.	20.1	0.85	3.18	0.80	2.0	11.4	223	2.0	12.7
French Colombard	1946–58	5	10	7 Sept.	20.9	1.13	3.26	0.90	2.8	11.3	300	14.9	(13.6)
French Colombard	1959–71	9	27	14 Sept.	21.3	0.94	3.43	0.72	2.5	11.7	331	10.7	13.7
Helena	1959–71	3	5	27 Aug.	21.1	0.84	3.29	0.79	1.9	12.1	229	M	13.2
La Reinha	1959–71	4	4	26 Sept.	19.6	0.68	3.59	0.61	1.9	11.1	135	2.0	10.9
Palomino	1935–42	3	9	17 Aug.	21.5	0.42	3.88	0.31	2.2	11.1	500	L	——
Palomino	1946–58	1	3	28 Sept.	19.9	0.38	3.80	0.40	——	11.4	——	L	(11.4)
Palomino	1959–71	4	5	25 Sept.	17.6	0.48	3.60	0.51	2.0	11.1	250	3.5	12.1
Peverella	1946–58	4	6	8 Sept.	22.3	0.93	3.37	0.78	2.9	12.0	300	7.1	(13.3)
Peverella	1959–71	5	7	15 Sept.	22.4	0.91	3.38	0.79	2.5	12.8	340	6.9	11.8
Sauvignon blanc	1935–42	1	1	15 Aug.	22.9	0.79	3.35	0.62	2.6	12.5	600	12.0	——
Sauvignon blanc	1946–58	2	2	30 Aug.	23.1	0.60	3.40	0.60	2.3	13.5	300	7.5	(12.3)
Sauvignon blanc	1959–71	1	2	27 Aug.	19.5	1.08	3.27	0.83	——	11.4	195	M	12.4
Sauvignon vert	1935–42	6	14	20 Aug.	23.1	0.48	3.76	0.42	2.7	11.9	400	18.6	——
Sémillon	1935–42	6	9	21 Aug.	22.2	0.50	3.50	0.43	2.7	12.1	400	24.6	——
Sémillon	1946–58	7	11	17 Aug.	22.0	0.61	3.53	0.50	2.9	11.8	200	18.9	(13.3)
Sémillon	1959–71	3	4	2 Sept.	19.4	0.78	3.40	0.70	2.3	11.0	168	4.0	11.8
Sylvaner	1946–58	3	3	26 Aug.	22.9	0.64	3.67	0.52	2.6	12.7	200	13.3	(12.6)
Thompson Seedless	1946–58	3	8	5 Sept.	21.8	0.60	3.48	0.52	2.2	11.8	200	5.2	(12.6)
Thompson Seedless	1959–71	8	128	10 Sept.	21.3	0.62	3.55	0.55	2.1	12.5	176	6.5	13.0
White Riesling	1959–71	3	26	16 Aug.	20.7	0.90	3.44	0.76	1.9	11.7	252	M	12.7

* Color values increase as color increases. Low (L) values are from 2–7, medium (M) from 8–12, and high above 12.

† Scores on a 0–20 point system. Values in parentheses are those of one taster only, the rest are for a panel of 10 experienced tasters. Score ranges proposed are: 9 to 12, wines commercially acceptable but having outstanding defects; 13 to 16, wines commercially acceptable but having no outstanding defects or characteristics.

TABLE 2

ANALYTICAL AND SENSORY DATA FOR EVALUATION OF RED TABLE WINE GRAPES IN MADERA, FRESNO, TULARE, AND KERN COUNTIES.

Variety	Years tested	Number of years sampled	Number of samples	Average date of harvest	Must analysis			Wine analysis					
					°Brix	Total acid (g H_2Ta per 100 ml)	pH	Fixed acid (g H_2Ta per 100 ml)	Extract (g per 100 g)	Ethanol (per cent v per v)	Total phenols (mg per l)	Color intensity*	Average sensory score†
Alicante Bouschet	1959–71	3	4	23 Sept.	20.0	0.67	3.41	0.77	2.6	11.0	2460	H	13.1
Barbera	1935–42	3	4	20 Aug.	22.1	0.82	3.24	0.62	2.9	10.8	900	134	. . .
Barbera	1946–58	6	6	7 Sept.	22.8	1.07	3.28	0.94	3.1	11.1	800	143	(13.3)
Barbera	1959–71	3	5	28 Aug.	23.5	0.99	3.26	0.88	2.8	13.2	921	M	13.3
Cabernet Sauvignon	1935–42	5	5	26 Aug.	23.3	0.54	3.45	0.52	3.1	12.0	1500	240	. . .
Cabernet Sauvignon	1946–58	5	5	22 Aug.	21.2	0.76	3.34	0.52	2.8	10.6	1000	127	(13.6)
Cabernet Sauvignon	1959–71	2	3	9 Sept.	20.6	0.93	3.38	0.72	2.4	10.7	1100	M	12.7
Calzin	1959–71	9	10	17 Sept.	20.9	0.65	3.56	0.59	2.9	11.1	2310	124	12.0
Carignane	1935–42	3	10	3 Sept.	22.2	0.58	3.73	0.46	..	11.6	1200	171	. . .
Carignane	1946–58	2	4	15 Aug.	20.3	0.86	3.40	0.71	2.7	11.6	900	169	(12.7)
Carignane	1959–71	4	9	17 Sept.	20.1	0.89	3.54	0.70	2.5	10.6	846	57	11.7
Grenache	1935–42	2	5	3 Sept.	23.1	0.45	3.95	0.39	2.4	11.5	1000	102	. . .
Grenache	1946–58	5	11	21 Sept.	22.9	0.67	3.40	0.55	2.8	12.1	900	65	(13.4)
Grenache	1959–71	9	31	27 Aug.	22.3	0.66	3.44	0.54	2.4	12.6	900	51	11.9
Grignolino	1935–42	6	7	28 Aug.	23.8	0.59	3.63	0.54	3.0	12.2	2100	44	. . .
Grignolino	1946–58	5	5	3 Sept.	21.5	0.88	3.30	0.75	3.0	11.2	1100	66	(13.6)
Malbec	1959–71	1	15	2 Sept.	21.4	0.81	3.74	0.64	2.8	10.7	900	M	11.3
Niabell	1959–71	2	3	20 Sept.	19.0	0.51	3.84	0.41	2.9	9.6	1300	67	11.7
Petite Sirah	1935–42	6	12	29 Aug.	22.7	0.62	3.74	0.50	2.8	11.3	2100	411	. . .
Pinot noir	1959–71	3	16	16 Aug.	20.1	0.81	3.62	0.64	2.5	10.8	500	63	11.5
Pinot St. George	1935–42	7	20	17 Sept.	22.0	0.70	3.68	0.48	2.7	11.2	800	116	. . .
Pinot St. George	1946–58	3	6	23 Sept.	20.5	0.63	3.57	0.65	2.8	10.6	800	108	(13.1)
Royalty	1959–71	2	2	6 Sept.	19.4	0.75	3.44	0.45	4.2	10.3	4200	435	13.9
Rubired	1959–71	1	1	3 Sept.	22.8	0.58	3.42	0.74	3.5	10.0	3000	2350	13.7
Ruby Cabernet	1946–58	3	3	28 Aug.	19.0	0.90	3.43	0.63	2.9	9.6	1200	142	(13.4)
Ruby Cabernet	1959–71	9	50	13 Sept.	22.5	0.73	3.62	0.65	2.9	11.7	1472	168	13.5
St. Macaire	1935–42	4	4	31 Aug.	22.6	0.60	3.30	0.49	2.9	11.8	1700	350	. . .
Salvador	1935–42	3	3	21 Aug.	23.4	0.67	3.19	0.66	3.4	11.3	3300	3270	. . .
Salvador	1959–71	5	9	14 Sept.	21.8	1.01	3.44	0.73	3.0	11.9	2908	2385	13.0
Tinta Madeira	1959–71	2	30	15 Aug.	21.3	0.77	3.65	0.61	3.1	11.3	1310	M	12.5
Valdepeñas	1946–58	3	3	26 Aug.	22.6	0.50	3.60	0.52	2.9	11.6	1500	151	(12.6)
Zinfandel	1935–42	4	14	29 Aug.	24.0	0.53	3.78	0.48	3.2	12.6	1700	241	. . .
Zinfandel	1946–58	3	3	1 Sept.	22.0	0.71	3.40	0.59	2.5	11.7	900	110	(13.7)
Zinfandel	1959–71	4	35	26 Aug.	21.2	0.94	3.52	0.79	3.0	11.6	900	M	11.7

* Color values increase as color increases. Low values are those less than 90, medium (M) are those from 90–200, high (H) are those over 200.

† Scores on a 0–20 point system. Values in parentheses are those of one taster only, the rest are for a panel of 10 experienced tasters. Score ranges proposed are: 9 to 12, wines commercially acceptable but having outstanding defects; 13 to 16, wines commercially acceptable but having no outstanding defects or characteristics.

TABLE 3

ANALYTICAL AND SENSORY DATA FOR EVALUATION OF WHITE DESSERT WINE GRAPES.

Variety	Years tested	Number of years sampled	Number of samples	Average date of harvest	Must analysis			Wine analysis					
					°Brix	Total acid (g H_2Ta per 100 ml)	pH	Fixed acid (g H_2Ta per 100 ml)	Extract (g per 100 g)	Ethanol (per cent v per v)	Total phenols (mg per l)	Color intensity*	Average sensory score†
Fernão Pirès	1946–58	4	4	23 Aug.	24.8	0.59	3.60	0.38	13.1	18.5	500	21.2	(14.2)
Malvasia bianca	1935–42	3	3	27 Aug.	23.9	0.43	3.56	0.38	10.8	19.3	400	46.6	. . .
Malvasia bianca	1946–58	2	2	28 Aug.	25.3	0.52	3.45	0.34	12.4	18.6	500	27.5	(14.4)
Mission	1935–42	2	3	8 Oct.	26.2	0.38	3.87	0.23	11.7	18.7	400	18.0	. . .
Mission	1946–58	1	3	5 Sept.	24.1	0.40	3.66	0.30	13.7	20.0	200	8.7	(14.5)
Mission	1959–71	3	3	25 Sept.	21.5	0.48	3.72	0.36	11.8	19.1	300	4.6	13.1
Muscat canelli	1935–42	5	8	17 Aug.	25.6	0.48	3.71	0.32	12.9	17.5	500	31.0	. . .
Muscat canelli	1946–58	7	7	26 Aug.	24.8	0.62	3.44	0.46	13.1	18.4	400	26.0	(14.0)
Muscat of Alexandria	1935–42	4	6	12 Sept.	24.9	0.44	3.97	0.30	13.0	18.2	300	52.5	. . .
Muscat of Alexandria	1959–71	6	8	18 Sept.	21.9	0.56	3.75	0.37	11.6	18.6	300	13.6	14.0
Orange Muscat	1935–42	2	2	18 Aug.	25.2	0.48	3.60	0.36	13.9	19.2	600	62.0	. . .
Orange Muscat	1946–58	4	6	2 Sept.	24.0	0.61	3.65	0.42	10.9	19.5	200	27.1	(14.0)
Orange Muscat	1959–71	7	12	8 Sept.	22.6	0.59	3.66	0.40	12.3	19.3	300	12.7	14.1

* Color values increase as color increases. Low values are from 2–7, medium from 8–12, and high above 12.

† Scores on a 0–20 point system. Values in parentheses are those of one taster only, the rest are for a panel of 10 experienced tasters. Score ranges proposed are: 9 to 12, wines commercially acceptable but having outstanding defects; 13 to 16, wines commercially acceptable but having no outstanding defects or characteristics.

TABLE 4

ANALYTICAL AND SENSORY DATA FOR EVALUATION OF RED DESSERT WINE GRAPES.

Variety	Years tested	Number of years sampled	Number of samples	Average date of harvest	Must analysis			Wine analysis					
					°Brix	Total acid (g H_2Ta per 100 ml)	pH	Fixed acid (g H_2Ta per 100 ml)	Extract (g per 100 g)	Ethanol (per cent v per v)	Total phenols (mg per l)	Color intensity*	Average sensory score†
Grenache	1935–42	4	5	22 Sept.	25.1	0.43	3.59	0.28	12.3	19.5	800	58	. . .
Grenache	1946–58	4	4	5 Sept.	23.2	0.63	3.47	0.52	11.7	18.6	600	77	(12.6)
Grenache	1959–71	2	2	8 Sept.	23.5	0.48	3.52	0.31	13.1	16.1	600	22	11.9
Muscat Hamburg	1935–42	4	5	31 Aug.	23.4	0.44	3.58	0.31	9.8	18.3	600	64	. . .
Royalty	1959–71	8	14	21 Sept.	21.9	0.62	3.63	0.51	11.1	18.7	2900	398	14.3
Rubired	1959–71	9	16	16 Sept.	21.9	0.90	3.53	0.59	12.3	18.4	3300	526	14.9
Souzão	1946–58	5	5	24 Aug.	22.3	0.84	3.42	0.60	7.8	18.0	1300	427	(14.5)
Souzão	1959–71	5	8	22 Sept.	22.2	0.60	3.90	0.45	11.6	18.5	1500	217	14.4
Tinto cão	1946–58	3	3	19 Sept.	21.8	0.62	3.73	0.38	12.8	20.7	700	306	(13.5)
Tinta Madeira	1946–58	5	11	30 Aug.	22.7	0.74	3.58	0.54	12.1	19.1	700	165	(14.4)
Tinta Madeira	1959–71	5	8	10 Sept.	23.6	0.57	3.87	0.42	12.6	18.8	1100	166	14.1
Trousseau	1935–42	6	15	25 Aug.	25.7	0.48	3.84	0.36	11.5	18.5	800	79	. . .
Trousseau	1946–58	5	9	5 Sept.	23.0	0.71	3.53	0.48	12.3	18.4	500	94	13.3

* Color values increase as color increases. Low values are those less than 90, medium are those from 90–200, high are those over 200.

† Scores on a 0–20 point system. Values in parentheses are those of one taster only, the rest are for a panel of 10 experienced tasters. Score ranges proposed are: 9 to 12, where commercially acceptable but having outstanding defects; 13 to 16, wines commercially acceptable but having no outstanding defects or characteristics.

TABLE 5.

VITICULTURE CHARACTERISTICS OF WINE GRAPE VARIETIES

Variety	Production (tons per acre)	Harvest period	Vigor	Harvestability		Other Important Characteristics
				Hand	Machine (juicing)	
			white table wine varieties			
Burger	9–12 (as high as 16)	9/15–10/7	Moderate	Easy	Hard (very heavy)*	Susceptible to bunch rot and overcropping. Total soluble solids tend to be low even with light crops.
Chenin blanc	9–12	8/20–9/25	High	Medium	Medium (medium)	Tight clusters can contribute to bunch rot. Minimized by early irrigation cut-off; prebloom gibberellin application, and use of fungicides. Best in fine sandy loams.
Emerald Riesling	9–13	8/20–9/30	Exceptional	Medium to hard	Very hard (very heavy)	Crushed grapes very susceptible to browning, requiring special care during harvest. Adaptable to all soil types.
French Colombard	9–14	9/5–9/25	Exceptional	Medium	Medium (medium)	Excess vigor can be a problem on deep, fertile soils. Dense foliage can interfere with sulfur dusting and harvest operations. Occasional bunch rot associated with powdery mildew problems or *Botrytis* infections. May need Zn correction.
Green Hungarian	12–15	9/15–9/25	High		(heavy)	Susceptible to bunch rot. Irrigation cut off prior to harvest reduces bunch rot and breakdown. Fails to ripen properly.
Helena	No recent experience					
Peverella	8–11	9/10–9/25	High	Easy to medium	Unknown	Compact clusters sometimes subject to rot. Dense foliage.
Saint-Emilion	10–13	9/5–9/30	High	Easy	Medium (heavy)	Fruit "holds" well on vine.
Sauvignon blanc	5–7	8/15–9/25	Exceptional	Hard (small clusters)	Medium (medium)	Excess, dense growth can interfere with sulfur dusting and harvest operations. Susceptible to *Botrytis* rot from fall rains.
Sauvignon vert	8–10	9/1–9/15	High	Medium		Fails to properly mature to desirable sugar. Acid is low.
Sémillon	7–11	8/15–9/1	Moderate	Medium	Medium to hard (very heavy)	Rot is sometimes a problem if the fruit is held on the vines too long.
Thompson Seedless	8–11	8/2–10/1	High	Easy	Easy (light)	Early harvest is desirable.
White Malaga	9–14	9/20–10/15	High	Easy	Very easy (none)	Principal advantages are the ease of growing and harvesting and the excellent holding characteristics of fruit on vine for late harvest and extending the crushing season.
White Riesling	3–5	8/15–9/15	Weak	Medium	Medium (medium)	Fruit breaks down rapidly when held beyond 19°B. Susceptible to bunch rot.

Alicante Bouschet	8–10	9/20–10/10	Moderate	Medium	No information	Compact clusters sometimes subject to bunch rot. Vines are sensitive to overcropping.
Barbera	6–10	9/10–10/5	Moderate	Easy	Medium (medium)	Leafroll virus is widespread in vineyards originating from non-certified planting stock. Vineyard establishment from cuttings often results in below normal initial stands.
Cabernet Sauvignon	5–7	8/15–9/10	Moderate	Medium	Easy to medium (light to medium)	Few problems but a very moderate producer. Tends to lack good fruit color.
Calzin	5–11	9/1–10/5	Moderate	Medium	Unknown	Resistant to red spider. Loose clusters and little rot.
Carignane	8–13	9/1–10/7	High	Medium	Medium to hard (hard)	Susceptible to powdery mildew. Summer bunch rot problems in some vineyards require pre-bloom gibberellin treatment. Yellow vein virus "unfruitful" vines found in many commercial plantings.
Gamay (Napa)	5–8	8/20–9/15	Moderate	Medium	Medium (medium to heavy)	Larger, compact clusters are subject to bunch rot.
Gamay Beaujolais	See Pinot noir					
Grenache	8–14	8/20–10/7	Very high	Medium	Medium to hard (medium)	Bloomtime *Botrytis* infections are sometimes a problem. Compact clusters sometimes rot. Subject to delayed bud break in spring and occasional poor fruit set. Good tolerance to salt and boron.
Grignolino	No recent experience					
Malbec	5–9	9/15–9/30	Moderate	Medium	Medium (medium)	Subject to poor fruit set under high nitrogen conditions.
Niabell	3–5	8/15–9/15	Low to moderate	Medium	Easy (light)	Berries subject to uneven ripening. Exposed fruit sunburns during hot spells. Fruit shrivels if harvest is delayed. Resistant to powdery mildew.
Pinot noir	4–5	8/10–8/25	Low to moderate	Medium to hard	Medium (medium)	Tight clusters subject to bunch rot, especially with delayed harvest. Fruit raisins badly with delayed harvest.
Pinot St. George	No experience					
Petite Sirah	6–10	9/5–10/1	Moderate	Medium	Medium to hard (medium to heavy)	Tight clusters are subject to rot. Fruit tends to sunburn and raisin from hot spells or delayed harvest. Leafroll and corky bark vines prevalent in older commercial plantings.
Royalty	7–10	9/1–9/30	Moderate	Medium	Easy (medium)	Moderate tolerance to berry mildew. Other viticultural characteristics or problems similar to Rubired except that Royalty vines tend to be weaker, especially with soil limitations such as a sandy texture.

TABLE 5 (CONTINUED)

VITICULTURE CHARACTERISTICS OF WINE GRAPE VARIETIES

Variety	Production (tons per acre)	Harvest period	Vigor	Harvestability		Other Important Characteristics
				Hand	Machine (juicing)	
Red table wine varieties						
Rubired	8–12	9/1–9/25	High	Medium	Easy (medium)	Tolerant to berry mildew. Young vines subject to collar rot. Young vines easily overcropped. Many commercial vineyards are infected with leafroll virus. Crop estimate is difficult because of high percentage of stems per cluster.
Ruby Cabernet	6–10	9/1–10/1	Moderate	Hard	Medium to hard (medium to heavy)	Performs very poorly in soils with limiting factors such as sandy texture, compaction, nematode problems, or shallow depth. Irregular berry set occasionally. Many commercial vineyards are infected with leafroll virus.
Salvador	7–11	8/15–9/15	Moderate	Hard	Easy (medium)	Resistant to powdery mildew and somewhat resistant to hoppers, mites, and grape leaffolder. High thrips populations sometimes stunt shoot growth. Tight clusters subject to bunch rot. Harvest should not be delayed. Difficult to prune—bushy growth.
St. Macaire	7–10	9/15–10/5	Moderate	Easy to medium	Medium to hard (medium to heavy)	Grapes tend to sunburn if vines are dried up early. Medium-to-large clusters.
Valdepeñas	10–12	8/20–9/20	High	Easy to medium	Medium to hard (medium to heavy)	Heavy, dense leaf area and powdery mildew susceptibility requires especially good sulfur dusting practices. Vines leaf out late.
Zinfandel	5–9	9/7–9/25	Low to moderate	Medium	Hard (medium to heavy)	Susceptible to spider mites. Bunch rot problem during ripening requires pre-bloom gibberellin spray. Exposed ripening fruit subject to raisining.
White dessert wine varieties						
Fernão Pirès	7–9	8/20–9/15	Moderate	Easy to medium	No experience	Sound fruit, good sugar and acid.
Palomino	8–12	9/10–9/30	High	Easy	Medium (heavy)	If overcropped will not mature and will rot. Generally picked at lower °Brix for sherry and blending material.
Mission	8–14	9/25–10/25	Very high	Easy to medium	Medium to hard (medium)	Considered more susceptible to crown gall and tends to attract sharp shooter leafhoppers, making Pierce disease losses more common. Fruit holds well on vine, achieving high sugar levels.
Verdelho	7–9	8/15–9/10	Moderate	Medium	No experience	Produces sound, clean fruit which begins to shrivel if harvest is delayed.
Thompson Seedless, White Malaga previously listed						

Malvasia bianca	5–8	8/15–9/10	Moderate	Medium	No experience	Somewhat open growth can result in considerable fruit sunburn during May or June hot spells. Erratic low producer.
Muscat blanc	6–8	8/15–9/5	Moderate	Medium	Hard (heavy)	Exposed, ripening fruit subject to sunburn. Fruit will raisin on vine if harvest is delayed. Compact clusters can bunch rot, especially with delayed harvest. Variety "suckers" badly.
Muscat of Alexandria	3–6	9/7–10/15	Moderate	Easy	Easy to medium (light)	Subject to zinc deficiency. Exposed fruit subject to burn in hot spells. Overcropping is common on cordon-trained vines, resulting in alternate-bearing tendencies and shortened vine life. Affected adversely by high salt and boron.
Orange Muscat	3–6	8/20–9/15	Weak	Medium	No experience	Very susceptible to salt or boron damage. Generally poor foliage and fruit sunburns and raisin.
			Red dessert wine varieties			
Souzão	6–8	9/15–9/30	Low-moderate	Medium	Medium (medium)	Fruit doesn't hold well on wine and raisins badly if harvest is delayed. High boron and salt adversely affect growth.
Tinto cão	5–7	9/15–10/5	High	Hard (many small clusters and heavy growth)	No experience	Small clusters, but quite fruitful.
Tinta Madeira	6–9	8/20–9/10	Moderate	Easy to medium	Medium to hard (medium)	Compact clusters require pre-bloom gibberellin spray to reduce bunch rot. Fruit tends to raisin on vine beyond 22°B. Adversely affected by high boron or salt.
Trousseau	No recent experience					Clusters tend to be very tight and to rot.
Carignane, Grenache, Royalty, and Rubired previously listed.						

* Values in parentheses describe the degree of juicing.

TABLE 6

SOME PRODUCTION RECORDS FOR WINE VARIETIES GROWN AT WEST SIDE FIELD STATION WITH HIGH SALT AND BORON IRRIGATION WATER*

Variety	Production (tons per acre)	
	Range	Average
Calzin	5–11	6.7
French Colombard	9–13	11.9
Grenache	5–12	8.3
Muscat of Alexandria	4–8	5.6
Orange Muscat	2.5–6	3.9
Royalty	5–14	7.6
Rubired	4–11	8.9
Ruby Cabernet	5.5–8.5	7.1
Souzão	3–7	5.1
Thompson Seedless	5–10	7.1
Tinta Madeira	6–9	6.7

* Compiled from yields of 25 to 30 vines for each variety over a 5- to 7-year period of mature vines. Each variety was established on six vines each of own-rooted, St. George, Salt Creek, 1613, and 1616 rootstocks.

LITERATURE CITED

ALLEY, C. J., C. S. OUGH, and M. A. AMERINE

1971. Grapes for Table Wines in California's Regions IV and V. Wines & Vines, 32(3):20–22.

AMERINE, M. A.

1965. Laboratory Procedures for Enologists. 100 pp. University of California, Davis.

AMERINE, M. A., and A. J. WINKLER

1944. Composition and quality of musts and wines of California grapes. Hilgardia. 15:493–673.

1963. California wine grapes. Composition and quality of their musts and wines. University of California, Agr. Exp. Sta. Bul. 794. 83 pp.

KASIMATIS, A. N., L. P. CHRISTENSEN, D. A. LUVISI, and J. J. KISSLER

1972. Wine and grape varieties in the San Joaquin Valley. Agr. Ext., University of California. AxT-n26. August. 54 pp.

OUGH, C. S., and G. A. BAKER

1961. Small panel sensory evaluations of wines by scoring. Hilgardia. 30:587–619.

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To simplify the information, it is sometimes necessary to use trade names of products or equipment. No endorsement of named products is intended nor is criticism implied of similar products not mentioned.

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